DATA SHEET

AU211/LM111/211/311/311B
Voltage comparator

Product data
Supersedes data of 2001 Aug 03

2003 Sep 30

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DESCRIPTION

The LM111 series are voltage comparators that have input currents approximately a hundred times lower than devices like the μA710. They are designed to operate over a wider range of supply voltages; from standard ±15 V op amp supplies down to a single 3 V supply. Their output is compatible with RTL, DTL, and TTL as well as MOS circuits. Further, they can drive lamps or relays, switching voltages up to 50 V at currents as high as 50mA.

Both the inputs and the outputs of the LM111 series can be isolated from system ground, and the output can drive loads referred to ground, the positive supply, or the negative supply. Offset balancing and strobe capability are provided and outputs can be wire-ORed.

Although slower than the μA710 (200 ns response time versus 40 ns), the devices are also much less prone to spurious oscillations. The LM111 series has the same pin configuration as the μA710 series.

FEATURES

- Operates from single 3 V supply (LM311B)
- Maximum input bias current: 150 nA (LM311: 250 nA)
- Maximum offset current: 20 nA (LM311: 50 nA)
- Differential input voltage range: ±30 V
- Power consumption: 135 mW at ±15 V
- High sensitivity: 200 V/mV
- Zero crossing detector

PIN CONFIGURATION

D, N Packages

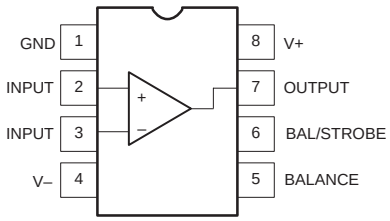


Figure 1. Pin Configuration

APPLICATIONS

- Precision squarer
- Positive/negative peak detector
- Low voltage adjustable reference supply
- Switching power amplifier

ORDERING INFORMATION

DESCRIPTION	TEMPERATURE RANGE	ORDER CODE	DWG #
8-Pin Plastic Small Outline Package (SO)	–40 °C to +125 °C	AU211D	SOT96-1
8-Pin Plastic Small Outline Package (SO)	–55 °C to +125 °C	LM111D	SOT96-1
8-Pin Plastic Dual In-Line Package (DIP)	–55 °C to +125 °C	LM111N	SOT97-1
8-Pin Plastic Small Outline Package (SO)	–25 °C to +85 °C	LM211D	SOT96-1
8-Pin Plastic Dual In-Line Package (DIP)	–25 °C to +85 °C	LM211N	SOT97-1
8-Pin Plastic Small Outline Package (SO)	0 °C to +70 °C	LM311D	SOT96-1
8-Pin Plastic Dual In-Line Package (DIP)	0 °C to +70 °C	LM311N	SOT97-1
8-Pin Plastic Small Outline Package (SO)	0 °C to +70 °C	LM311BD	SOT96-1
8-Pin Plastic Dual In-Line Package (DIP)	0 °C to +70 °C	LM311BN	SOT97-1

EQUIVALENT SCHEMATIC

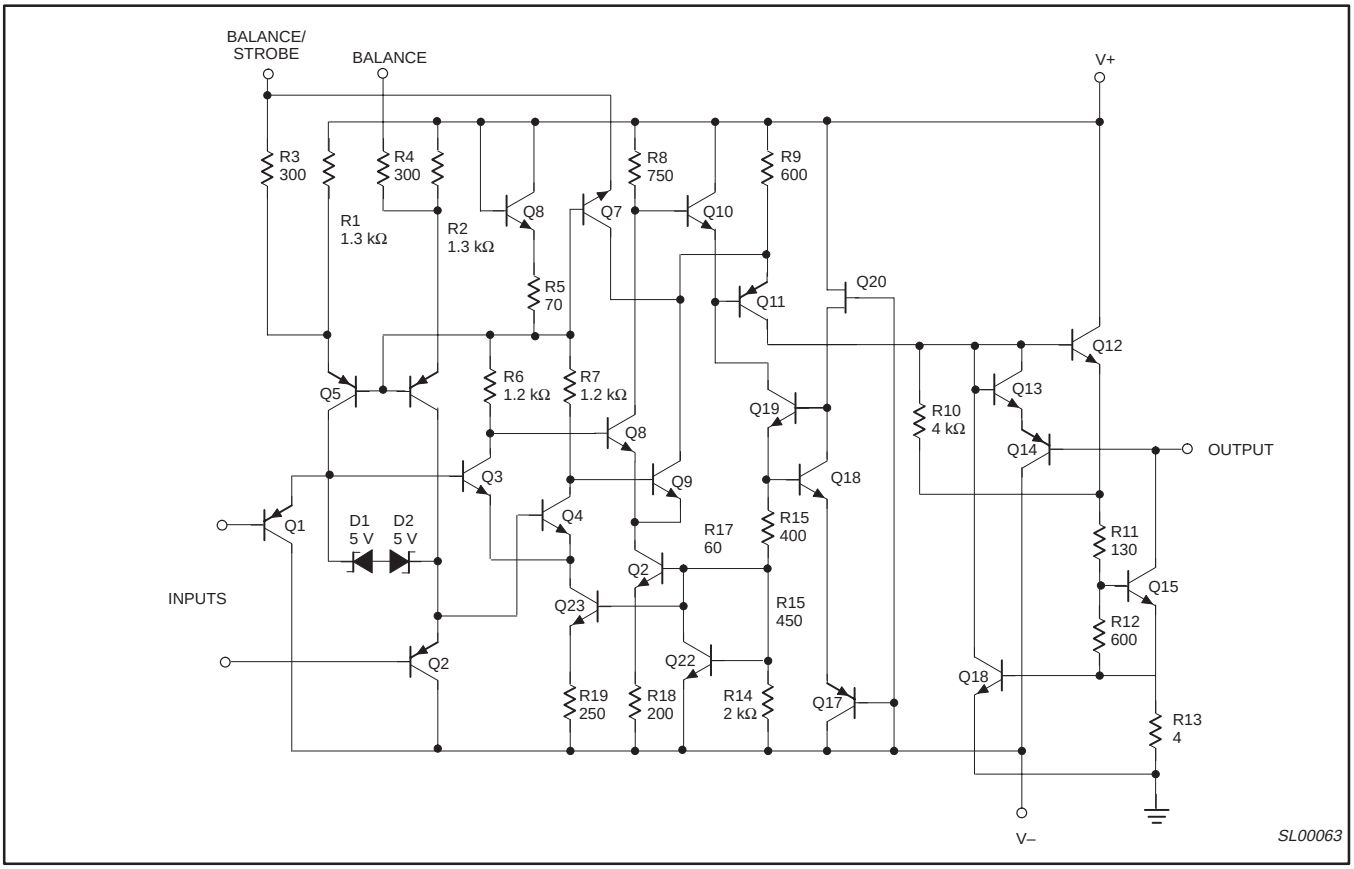


Figure 2. Equivalent Schematic

ABSOLUTE MAXIMUM RATINGS

SYMBOL	PARAMETER		RATING	UNIT
V_S	Total supply voltage		36	V
	Output to negative supply voltage	LM111/LM211	50	V
		LM311/LM311B	40	V
	Ground to negative supply voltage		30	V
	Differential input voltage		±30	V
V_{IN}	Input voltage [1]		±15	V
$P_{D\ MAX}$	Maximum power dissipation, T_{amb} = 25 °C (still-air) [2]	N package	1190	mW
		D package	780	mW
I	Output short-circuit duration		10	sec
T_{amb}	Operating ambient temperature range	AU211	–40 to +125	°C
		LM111	–55 to +125	°C
		LM211	–25 to +85	°C
		LM311/LM311B	0 to +70	°C
T_{stg}	Storage temperature range		–65 to +150	°C
T_{sld}	Lead soldering temperature (10 sec max)		230	°C

NOTES:

1. This rating applies for ±15 V supplies. The positive input voltage limit is 30 V above the negative supply. The negative input voltage limit is equal to the negative supply voltage or 30 V below the positive supply, whichever is less.
2. Derate above 25 °C, at the following rates:
   N package at 9.5 mW/°C
   D package at 6.2 m/W°C

DC ELECTRICAL CHARACTERISTICS[1, 2, 3, 6]

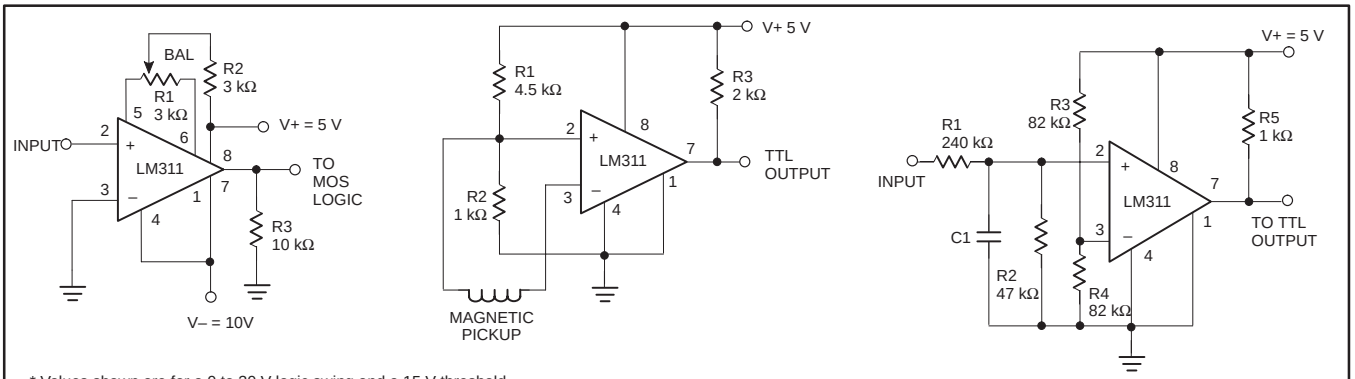
Over temperature range unless otherwise specified.

SYMBOL	PARAMETER	TEST CONDITIONS	AU211 LM111/LM211			LM311			LM311B			UNIT
			Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
V_{OS}	Input offset voltage[3]	T_{amb} = 25 °C; $R_S \leq 50$ kΩ		0.7	3.0		2.0	7.5		2.0	7.5	mV
I_{OS}	Input offset current[3]	T_{amb} = 25 °C		4.0	10		6.0	50		6	25	nA
I_{BIAS}	Input bias current	T_{amb} = 25 °C		60	100		100	250		100	200	nA
A_V	Voltage gain	T_{amb} = 25 °C		200			200			200		V/mV
	Response time[4]	T_{amb} = 25 °C		200			200			500		ns
V_{SAT}	Saturation voltage	LM111/211 $V_{IN} \leq$ –5mV; I_{OUT} = 50 mA LM311/B $V_{IN} \leq$ –10 mV; I_{OUT} = 50 mA T_{amb} = 25 °C		0.75	1.5		0.75	1.5		0.75	1.5	V
$I_{BAL/STR}$	Strobe on current	T_{amb} = 25 °C		3.0			3.0			3.0		mA
$I_{LEAKAGE}$	Output leakage current[6]	LM111/211 $V_{IN} \geq$ 5 mV; V_{OUT} = 35 V LM311/B $V_{IN} \geq$ 10 mV; V_{OUT} = 35 V T_{amb} = 25 °C, I_{STROBE} = 3 mA (V– = V_{GND} = –5 V)		0.2	10		0.2	50		0.2	50	nA
V_{OS}	Input offset voltage[3]	$R_S \leq 50$ kΩ			4.0			10			10	mV
I_{OS}	Input offset current[3]				20			70			50	nA
I_{BIAS}	Input bias current				150			300			250	nA
V_{IN}	Input voltage range	V = ±15 V (Pin 7 may go to 5 V)	–14.5	13.8 to –14.7	13.0	–14.5	13.8 to –14.7	13.0	V– +0.5		V+ –1.5	V
V_{OL}	Saturation voltage[6]	V+ ≥ 4.5 V, V– = 0 V LM111/211 $V_{IN} \leq$ –6 mV; $I_{SINK} \leq$ 8 mA LM311/B $V_{IN} \leq$ –10 mV; $I_{SINK} \leq$ 8 mA		0.23	0.4		0.23	0.4		0.23	0.4	V
I_{OH}	Output leakage current	$V_{IN} \geq$ 5 mV; V_{OUT} = 35 V		0.1	0.5							µA
I_{CC}	Positive supply current	T_{amb} = 25 °C		5.1	6.0		5.1	7.5		1.6	3.5	mA
I_{EE}	Negative supply voltage	T_{amb} = 25 °C		4.1	5.0		4.1	5.0				mA

NOTES:

1. This rating applies for ±15 V supplies. The positive input voltage limit is 30 V above the negative supply. The negative input voltage limit is equal to the negative supply voltage or 30 V below the positive supply, whichever is less.
2. These specifications apply for V_S = ±15 V and 0 °C < T_{amb} < 70 °C unless otherwise specified. With the LM211, however, all temperature specifications are limited to –25 °C ≤ T_{amb} ≤ +85 °C, for the AU211 is limited to –40 °C < T_{amb} < +125 °C, and for the LM111 is limited to –55 °C < T_{amb} < +125 °C. The offset voltage, offset current, and bias current specifications apply for any supply voltage from a single 5 V supply up to ±15 V supplies.
3. The offset voltages and offset currents given are the maximum values required to drive the output within a volt of either supply with 1 mA load. Thus, these parameters define an error band and take into account the worst case effects of voltage gain and input impedance.
4. The response time specified is for a 100 mV input step with 5 mV over-drive.
5. Do not short the strobe pin to ground; it should be current driven at 3 mA to 5 mA.
6. LM311B, all parameters are at V+ = 3 V ±10%; V– = GND = 0 V.

TYPICAL APPLICATIONS



* Values shown are for a 0 to 30 V logic swing and a 15 V threshold.

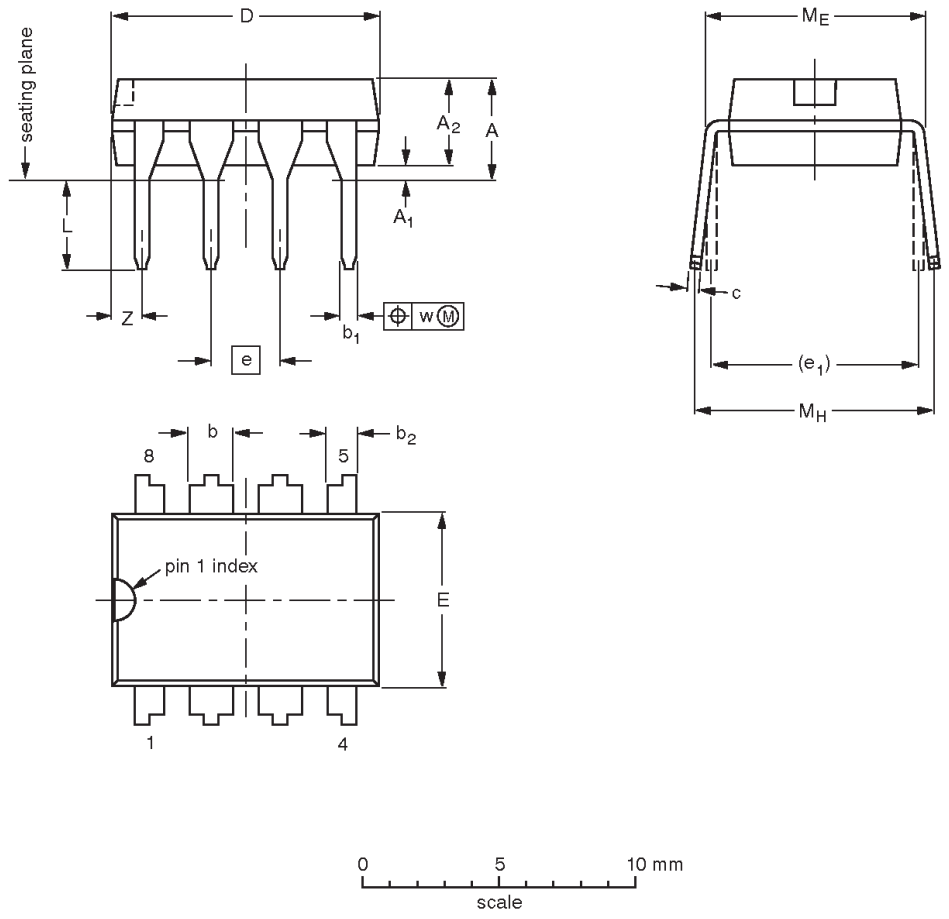
** May be added to control speed and reduce susceptibility to noise spikes.

Zero Detector Driving MOS Logic | **Detector for Magnetic Transducer** | **TTL Interface with High Level Logic**

SL00064

Figure 3. Typical Applications

DIP8: plastic dual in-line package; 8 leads (300 mil) **SOT97-1**



DIMENSIONS (inch dimensions are derived from the original mm dimensions)

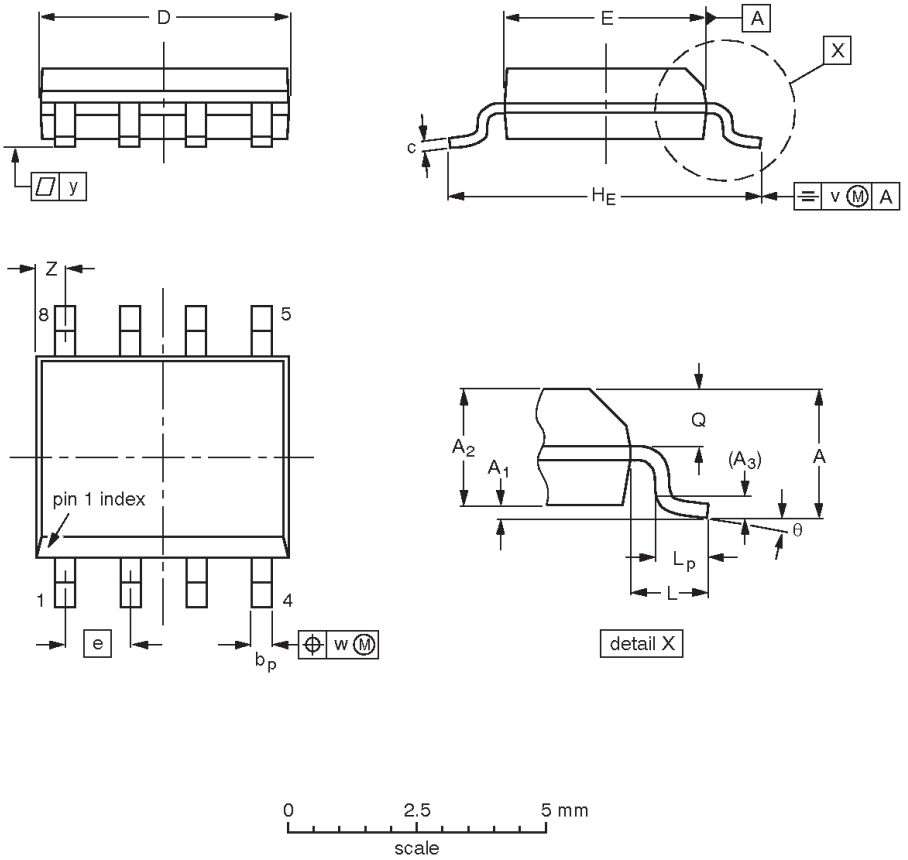
UNIT	A max.	A_1 min.	A_2 max.	b	b_1	b_2	c	D (1)	E (1)	e	e_1	L	M_E	M_H	w	Z (1) max.
mm	4.2	0.51	3.2	1.73 1.14	0.53 0.38	1.07 0.89	0.36 0.23	9.8 9.2	6.48 6.20	2.54	7.62	3.60 3.05	8.25 7.80	10.0 8.3	0.254	1.15
inches	0.17	0.02	0.13	0.068 0.045	0.021 0.015	0.042 0.035	0.014 0.009	0.39 0.36	0.26 0.24	0.1	0.3	0.14 0.12	0.32 0.31	0.39 0.33	0.01	0.045

Note

1. Plastic or metal protrusions of 0.25 mm (0.01 inch) maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT97-1	050G01	MO-001	SC-504-8			~~99-12-27~~ 03-02-13

SO8: plastic small outline package; 8 leads; body width 3.9 mm **SOT96-1**



DIMENSIONS (inch dimensions are derived from the original mm dimensions)

UNIT	A max.	A_1	A_2	A_3	b_p	c	$D^{(1)}$	$E^{(2)}$	e	H_E	L	L_p	Q	v	w	y	$Z^{(1)}$	θ
mm	1.75	0.25 0.10	1.45 1.25	0.25	0.49 0.36	0.25 0.19	5.0 4.8	4.0 3.8	1.27	6.2 5.8	1.05	1.0 0.4	0.7 0.6	0.25	0.25	0.1	0.7 0.3	8^o 0^o
inches	0.069	0.010 0.004	0.057 0.049	0.01	0.019 0.014	0.0100 0.0075	0.20 0.19	0.16 0.15	0.05	0.244 0.228	0.041	0.039 0.016	0.028 0.024	0.01	0.01	0.004	0.028 0.012	

Notes

1. Plastic or metal protrusions of 0.15 mm (0.006 inch) maximum per side are not included.
2. Plastic or metal protrusions of 0.25 mm (0.01 inch) maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT96-1	076E03	MS-012				~~99-12-27~~ 03-02-18

REVISION HISTORY

Rev	Date	Description
_3	20030930	**Product data (9397 750 12106). ECN 853-0927 30378 of 26 September 2003. Replaces LM111_211_311_311B_2 (9397 750 09216) of 2001 Aug 03.** Modifications: • Add Type number AU211. • DC electrical characteristics, Note 2, on page 4: add "for the AU211 is limited to –40 °C < T_{amb} < +125 °C".
_2	20010803	**Product data (9397 750 09216). ECN 853-0927 26834 of 03 August 2001. Supersedes data of 1994 Aug 31.**

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Level	Data sheet status [1]	Product status [2] [3]	Definitions
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Date of release: 09-03

Document order number: 9397 750 12106

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